

Phakphum Aramrun<sup>1</sup>, Nicholas A. Beresford<sup>2</sup>, Robert Young<sup>1</sup>, Michael D. Wood<sup>1</sup>

<sup>1</sup>University of Salford, <sup>2</sup>NERC-CEH



## 1 Overview

- Radioecology is the study of environmental radioactivity and the consequences to living organisms in the ecosystem that are continuously exposed to ionizing radiation from natural radioactivity and artificial radioactivity
- Radionuclides released into an ecosystem and accumulation within soil, air, water and sediment are one of the main concerns in terms of long term effects of ionizing radiation in wildlife [1]
- Terrestrial wild animal radiation exposure can be estimated using computer models (evaluated via model inter-comparison studies) [e.g. 3,4]
- These model predictions require validation, but few studies have attempted to measure dose directly [e.g. 5,6] and this has been based on thermoluminescent dosimeter (TLD) measurements. More comprehensive validation data are required.
- Also, there are no published data on long-term effects combined with direct dose measurements under field conditions for mammals or birds. This impacts on our ability to understand field effects observations.

## 2 Aim

- To develop practical dose measurement technologies for accurately assessing external radiation exposure in terrestrial wild mammals and birds under field conditions to better enable long term effects studies to be interpreted and validate existing dosimetry models
- The focus will be on canid species, small mammals and birds

## 3 Objective

The objectives of this research can be divided into 3 stages;

### Stage 1

- Identify and analyze current passive dosimetry technologies that are likely appropriate for measurement of external absorbed dose in target wild animals (canids, mice and ducks) for validation around regulated sites.
- Identify: the target animals' behavior and home range parameters which may influence radiation dose; likely environmental dose rate ranges and; likely radionuclide profiles.

### Stage 2

- Develop and design new environmentally robust methods for mounting well-chosen passive dosimetry technologies together with Global Positioning System (GPS) tracking telemetry on collars for accurately measuring gamma absorbed dose
- Calibrate collars for radionuclide energies, dose rate ranges and other parameters that are likely to be encountered in target testing sites.
- Evaluate current, and where necessary develop new, conversion factors for converting measurement results to whole body absorbed dose.

### Stage 3

- Test the methods and techniques developed on target terrestrial wild animals at terrestrial field sites.
- Quantify the gamma absorbed dose rates animals received and convert them to whole body doses.

## 4 Passive dosimetry technologies

- **Luminescence dosimetry**, the most widely employed passive system [7], includes:
  - **Thermoluminescent dosimeter (TLD)** emits light when heated, the light being proportional to the radiation exposure of the TLD. There are many kinds of TL material such as Lithium Fluoride (LiF), Calcium Fluoride (CaF<sub>2</sub>), Calcium Sulphate (CaSO<sub>4</sub>), Lithium Borate (Li<sub>2</sub>B<sub>4</sub>O<sub>7</sub>) and Aluminium trioxide (Al<sub>2</sub>O<sub>3</sub>).
  - **Optical stimulated luminescent dosimeter (OSLD)** energy is provided by stimulating the phosphor material (Al<sub>2</sub>O<sub>3</sub>:C) with visible or near infrared light after exposing to ionising radiation.
  - **Photoluminescent dosimeter (RPL)** uses silver activated phosphate glass as a luminescence material. When exposed to UV-light, the radiation induced RPL fluorescence light is then emitted.
- **Direct Ion Storage (DIS)** is an electronic dosimeter that can be quickly read onsite [8]. For example, the Instadose 2 is a DIS dosimeter that can be read by smartphones and personal computers [8]
- **Electron paramagnetic resonance (EPR) dosimetry** is a physical method for calculating absorbed dose. This method can show information on exposure to radiation in past years, known as retrospective dosimetry [9]
- **Photographic film** was one of the first techniques that was used as a dosimeter [10] but it is now starting to become more obsolete. However, it should be evaluated as whether or not it is a suitable dosimeter for measuring in this research. **Radiochromic film**, a type of film dosimeter, is being studied in the first stage of this research.

**The final selection of dosimetric methodology will depend on size of dosimeter, energy dependence, dose range, fading, environmentally robust properties and cost**

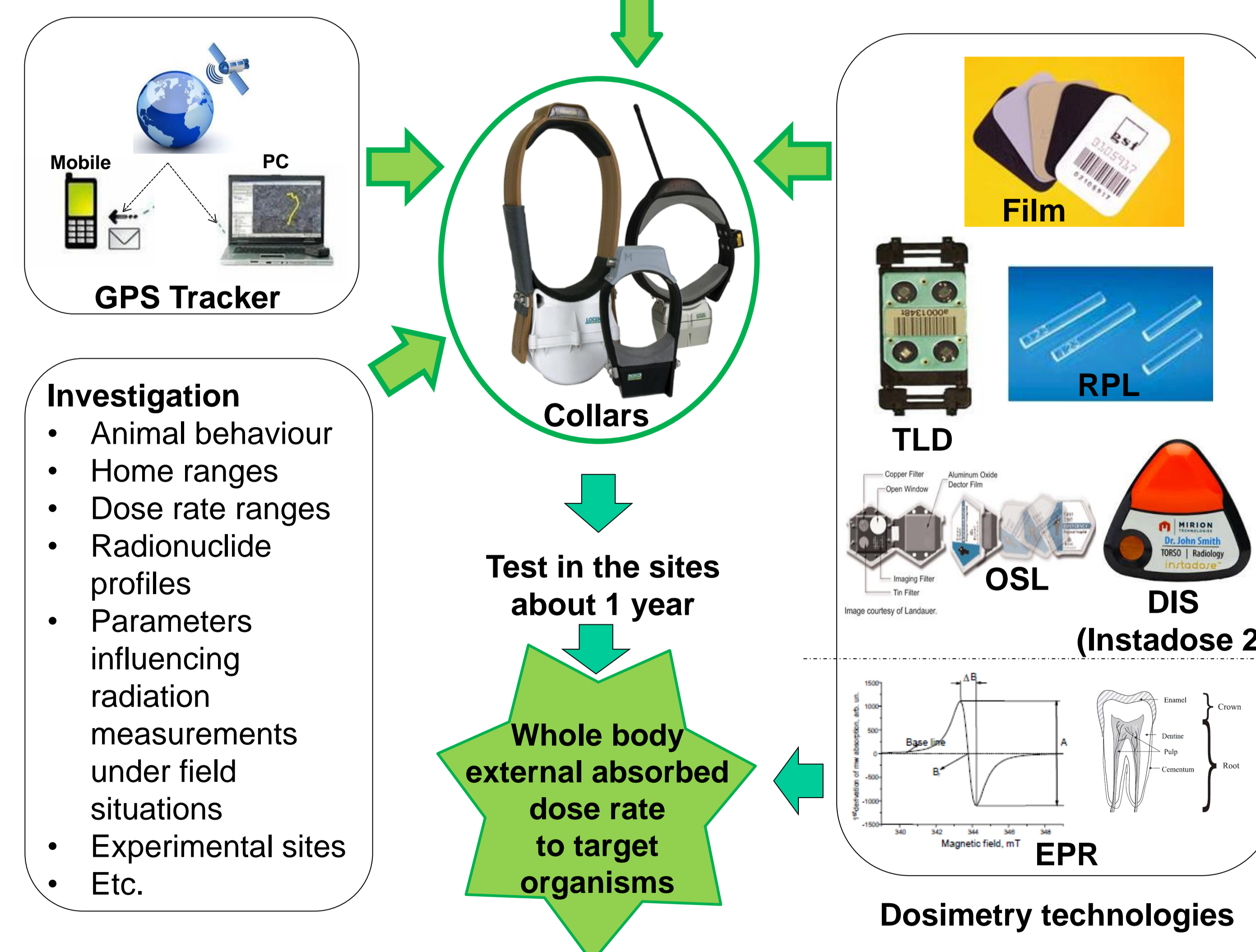


Surrounding nuclear licensed site

Release and discharge radionuclides into environment



Target terrestrial wild organisms



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